Practitioner's Docket No.: 811_106 *PATENT*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of: Takao SAITO, Yukinori NAKAMURA, Yoshimasa KONDO and Naoto OHTAKE

Serial No.: 10/774,454 Art Unit: 1792

Dated Filed: February 10, 2004 Examiner: David P. Turocy

Confirmation No.: 9153

FOR: THIN FILMS ANDA METHOD FOR PRODUCING THE SAME

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

DECLARATION UNDER 37 CFR §1.132

Sir:

I, Takao Saito, a citizen of Japan hereby declare and state:

1. I have a doctor of philosophy degree in engineering which was conferred upon me by Tohoku University in Miyagi Prefecture, in 2001.

2. I have been employed by NGK Insulators, Ltd. since 2001 and I have had a total of 8 years of work and research experience in pulse plasma technology. I am one of the inventors in the above-identified patent application and I am familiar with the references applied in the Office Action mailed October 17, 2008.

3. Based on my education and experience, I consider myself to be one of ordinary skill in the art to which the presently claimed invention pertains.

4. The diamond-like carbon (DLC) film produced by Yara has a polycrystalline structure based on the diamond layer observed by SEM according to paragraphs [0051] – [0054] of Yara. The DLC film of Yara has a Raman main peak at a wavelength of about 1332 cm^{-1} (Yara paragraph [0099]).

5. The DLC produced by the method of the present application is substantially amorphous DLC of good quality. The Raman main peak at a wavelength of 1580 cm^{-1} (i.e., "G" band) is a physical characteristic of DLC of good quality, as shown in Figs. 3-4 and discussed at paragraphs [0030] – [0031] of the present specification.

6. The Raman main peak at 1475 cm^{-1} and 1548 cm^{-1} in Hartmann are caused from amorphous carbon structure impurities in the diamond and the Raman main peak at 1500 cm^{-1} and 1590 cm^{-1} in Awazu are caused by linear carbon-to-carbon bonds without hydrogen impurities and crystalline graphite impurities, respectively. The Raman main peak caused by the DLC formed in Hartmann is about 1340 cm^{-1}, as shown in Fig. 4 of Hartmann. Similarly, the Raman main peak caused by the disordered graphite structure of DLC formed in Awazu is about 1360 cm^{-1}.

7. The Raman main peak of 1580 cm^{-1} of the DLC produced by the method of the present application is not due to impurities, such as disclosed by Hartmann and Awazu, but caused by the structure of the substantially amorphous DLC.

8. The pulse voltage used to produce a DLC film first generates a plasma to produce ion species (plasma actuated species), and then the generated ion species are physically moved onto the substrate surface to produce the DLC film. In early 2004, when the present application was filed, it was commonly believed that about 20 microseconds was needed to move the generated ion species onto the substrate surface

using the applied electric field under low pressure of vacuum. The time required to move the generated ion species would be greater under standard atmosphere pressure since the density of molecules in the space interfering with the movement of the generated ion species is greater.

9. While Yara states that pulse durations of 1 microsecond (1000 nanoseconds) or greater could be used, after reading the disclosure of Yara in its entirety, I concluded that Yara actually discloses data for only pulse durations of 20 microseconds (20,000 nanoseconds) in the disclosed examples. Therefore, Yara, when read in its entirety, does not disclose the formation of a polycrystalline DLC film at a pulse duration of less than 20 microseconds.

10. Yara also specifically discloses that "if it [the pulse duration] is shorter than 1 microsecond, the discharge becomes unstable" (paragraph [0025]). Mizuno discloses generating a stable plasma using a pulse duration of less than 1 microsecond only under vacuum conditions (as discussed in the Amendment filed January 29, 2008). Since Mizuno fails to disclose any experimental results of the formation of any film using the stable plasma under vacuum condition with pulse durations of less than 1 microsecond, that reference would not lead me to expect that the disclosed pulse duration could generate a film.

11. I would have no reason to combine Mizuno with Yara as asserted by the PTO, because the pulse duration of less than 1 microsecond in Mizuno is only applicable under vacuum conditions and would not be applicable to pressure conditions of 100 to 1600 Torr based on the known differences in the behavior of plasma arcs under vacuum at atmospheric conditions of 100 to 1600 Torr. For example, the number of molecules at

760 Torr, the atmospheric pressure of Yara, is 76 times the number of molecules at 10 Torr, the atmospheric pressure of Mizuno. The greater density of molecules makes it more difficult to form a stable plasma under 760 Torr (Yara). I believe that the plasma, as disclosed by Yara and Mizuno, would be unstable at a pressure of 10 Torr or greater and this instability would adversely affect the formation of the DLC film.

I hereby declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Date: Feb. 10, 2009 Signed: Takao Saito